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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
WONG, JOSEPH D	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/648,791	DAMM ET AL.	
	Examiner	Art Unit	
	Joseph D. Wong	2195	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *8/27/2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *20060515*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claims 1-19 are presented for examination. This office action is in response to the application filed on August 27, 2003. It consists of any appropriate objections under 37 CFR § 1.74-1.75; 1.84 and any appropriate rejections under 35 U.S.C. §101; §102; §103; §112, 2nd paragraph; and §112, 4th paragraph.

The examiner acknowledges receipt of an information disclosure statement (IDS) dated May 12, 2004 consistent with applicant's duty to disclose in 37 CFR § 1.56.

Claims 4-5, 11-13, and 16-17 will be considered under 35 U.S.C. § 112, 6th paragraph.

Invocation of 35 U.S.C. § 112, 6th paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

Drawings

The drawings are objected to because of improper shading for figures 2, 4, 6, and 10. 37 CFR § 1.84 (a)(1) dictates the sole use of black and white drawings. Gray shading is not permitted. According to 37 CFR § 1.84 (m), shading must be in the form of thin lines spaced closely together. Appropriate correction is required.

Figures 2, 4, 6, and 10 are objected to because they use a shaded surface in a manner that interferes with their comprehension. 37 CFR § 1.84(p)(3) states text "should not be placed upon hatched or shaded surfaces." Appropriate correction required.

Figures 1(a-d), 3, 4, and 11(a-d) are objected to because they use a font that is too small. 37 CFR § 1.84(p)(3) states that the font size must be at least 0.32 cm (or 1/8 inch) in height. Appropriate correction is required.

Figures 1-11 are objected to because they lack letters or numerals in the drawing and detailed description as required by 37 CFR § 1.74. Appropriate correction is required.

Specification

The specification is objected to because of the following informalities:
Paragraph [0002], line 11 is grammatically incorrect. The sentence "...procedures for controlling data flow are known to be..." is incomprehensible as written. Appropriate correction is required.
Paragraph [0005], lines 18 and 26 contain conflicting capitalizations of the term "Ipsec"[sic] and "IPsec". Proper consistency is required.

The specification is objected to because of the following informalities:

Paragraph [0004], line 13 lacks antecedent basis for the term "aforementioned range based algorithm".
Paragraph [0005], line 5 lacks antecedent basis for the term "specified subset of rules". Adequate definition of subset is required. Appropriate correction is required.

Claim Objections

Claims 1-5 are objected to because of the following informalities: the term "data" appears to be missing in the phrase "a first layer of the structure". For purposes of examination the term "structure" is interpreted as "data structure". Appropriate correction is required.

Claims 7 and 12 are objected to because of the following informalities: claims are missing required punctuation. The claims are not sentences as required. See MPEP § 608.01(m). Appropriate correction is required.

Claim 11 is objected to because it inconsistently refers to a method and a system. Appropriate correction is required.

Claims 15, 18 and 19 are objected to because of the following informality: the claims are out of order. Dependent claims must immediately follow the claim from which they depend. See MPEP § 608.01(n). Appropriate correction is required.

Claim Rejections - 35 U.S.C. § 112

The following is a quotation of the second paragraph of 35 U.S.C. § 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-7 are rejected under 35 U.S.C. § 112 second paragraph because the phrase "tree-like data structure" is vague and indefinite. By definition, a tree is a hierarchical structure comprised of nodes, each node having exactly one parent (except for the root, which has none) and zero or more children (*Microsoft Computer Dictionary Fourth Edition*, Microsoft Press, 1999, p. 451). Applicant's specification does disclose a "tree-like" data structure, but the aforementioned claims do not disclose that specific structure. A relative term such as "tree-like" is held indefinite because a person having ordinary skill in view of the prior art and the status of the art would be unclear how data structures other than trees would satisfy the limitations of the claim. See MPEP § 2173.05(b)(F) or Ex parte Caldwell, 1906 C.D. 58 (Comm'r Pat. 1906).

Claims 8-12, 15, and 18 are rejected under 35 U.S.C. §112 second paragraph because the phrase "augmented binary tree structure" is vague and indefinite. By definition, an augmented binary tree is a binary tree with increased functionality (*Introduction to Algorithms Second Edition*, The

MIT Press, 2001, p. 308). Applicant's specification does disclose an "augmented" binary tree structure, but the aforementioned claims do not limit the augmentation to the augmentation disclosed in the specification. A person having ordinary skill in the art in view of the prior art and the status of the art would be unclear how tree structures other than binary tree structures satisfy the relative language of "augmented" binary tree structures, thereby rendering the scope of the claims indefinite. See MPEP § 2173.05(b).

Claim Rejections - 35 U.S.C. § 101

35 U.S.C. § 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-5, 11-17, and 19 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

Claim 1 is non-statutory because it does not produce a tangible result. The claimed process is the embodiment of an abstract idea that does not produce a useful, concrete and tangible result as required by judicial interpretation. Read in its broadest reasonable interpretation, the term "creating", as it is used in the claim, means preparing or designing data structure layers. Mere preparation or design of a data structure does not require the production of a tangible result.

Claims 2 and 3 are also non-statutory because they do not produce a tangible result. The limitations added by claims 2 and 3 to the method of claim 1 fail to satisfy the requirement of a tangible result.

Claim 4 is non-statutory because it does not produce a tangible result and lacks a computer readable medium. In light of the specification, the "means for creating" data structure layers are interpreted as being implemented by software. According to judicial interpretation, in order to

be patentable, claims to software must be accompanied by a useful, concrete and tangible result. In particular, the software in this claim merely prepares or designs data structure layers. Mere preparation or design of a data structure does not require the production of a tangible result. Additionally, software cannot be claimed without a computer readable medium.

Claim 5 is non-statutory because it does not produce a tangible result and lacks a computer readable medium. The limitations added by claim 5 to the system of claim 4 fail to satisfy the requirement of a tangible result. It also lacks the required computer readable medium.

Claim 11 is non-statutory because there is no computer readable medium. In light of the Specification, the "means for projecting" and "means for forming" are interpreted as being implemented in software. A system of software alone cannot be patented. It must be claimed in conjunction with a computer readable medium.

Claims 12, 13, and 15 are non-statutory because they lack the required computer readable medium. The limitations added by the claims do not add a computer readable medium to the system of claim 11.

Claim 14 is non-statutory because it does not produce a tangible result. The claimed process is the embodiment of an abstract idea that does not produce a useful, concrete and tangible result as required by judicial interpretation. Read in its broadest reasonable interpretation, the phrases "combining overlapping intervals" and "evaluating the overlapping intervals", as used in the claim, do not produce a tangible result. Mere combination or evaluation of intervals does not require the production of a tangible result.

Claim 19 is non-statutory as applied to claim 14 because claim 19 does not produce a tangible result. The limitations added by claims 19 to the method of claim 14 fail to satisfy the requirement of a tangible result.

Claim 16 is non-statutory because it does not produce a tangible result and lacks a computer readable medium. In light of the specification, the "means for combining" and "means for evaluating" intervals are interpreted as being implemented by software. According to judicial interpretation, in order to be patentable, claims to software must be accompanied by a useful, concrete and tangible result. In particular, the software in this claim merely combines and evaluates intervals. Mere combination and evaluation of intervals does not require the production of a tangible result. Additionally, software per se cannot be claimed without a computer readable medium.

Claim 17 is non-statutory because it does not produce a tangible result and lacks a computer readable medium. The limitations added by claim 17 to the system of claim 16 fail to satisfy the requirement of a tangible result. It also lacks the required computer readable medium.

Claim Rejections - 35 U.S.C. § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5 are rejected under 35 U.S.C. § 102(b) as being anticipated by Herbert et al., Southeast Symposium on System Theory, March 18-20, 2001. Proceedings of the 33rd Southeastern Symposium on System Theory, pp. 315-318.

For claims 1 and 4, Herbert teaches:

A method (refers to claim 1) / system (refers to claim 4) of creating a tree-like data structure (See e.g. figure 3 in Herbert for a network tree-like topology or a sequential list of rules on p.317, paragraphs 7-8 which can also be interpreted as a tree) for use (see p.317, column 2, paragraph 2, Herbert's "ROUTER" in figure 3 is fully capable of making range-specified

address filtering decisions) in carrying out range-specified rule evaluations, (rejecting the IP addresses of 96.53.68.2 and 123.53.81.10) the data structure (see network topology in figure 3) having a rule specified rule set where each rule in the rule set has an equal number of fields (fixed number of fields listed in each ipchains command line on page 317, column 2, paragraphs 7 and 8) and each field specifies a range having an upper (address 0.0.0.0 inherently means any address in ipchain command in paragraph 9 implies a maximum address of 255.255.255.255) and lower (address 0.0.0.0 inherently means any address in paragraph 9 implies a minimum address of 0.0.0.0) bound, there being the same number of layers in the structure as there are fields in each rule set, the method comprising:

creating (see "create" on page 318, column 2, paragraph 1) a first layer of the structure (see Herbert's reference to a unique IP address on p. 315, 2nd paragraph, and exemplary "Outside" network in Herbert figure 3) made up of a set of non-overlapping ranges (unique address 198.146.83.21 in figure 3); and

creating one (see layer behind Herbert's router) or more additional layers each made up of sets of non-overlapping ranges (a globally unique IP address 198.146.83.21) and sets of overlapping ranges (see Herbert's table 2 of address ranges that enterprises can reuse and inside exemplary address of figure 3 of 10.10.10.1);

wherein range specified rule evaluations (address routing decisions occurring in the Router of figure 3) are carried out in one pass (wherein a packet visits each intermediate node once in figure 3) through the data structure (see figure 3 item network topology).

For claim 2 as applied to claim 1, Herbert teaches:

The method as defined in claim 1, wherein the data structure is a disjoint graph with the non-overlapping ranges (see p. 315, 2nd paragraph, column 1, unique IP address) representing elementary intervals and the overlapping ranges (see table 2 of shared private IP addresses) are disjoint intervals (see table 2, class A, B, C).

For claim 3 as applied to claim 2, Herbert teaches:

The method as defined in claim 2 wherein the range specified rule evaluations (address routing decisions) relate to packet (internet protocol packets) classification (routing decision) in communications systems (see network in Herbert's figure 3).

The limitation of claim 3 does have patentable weight.

For claim 5 as applied to claim 4, Herbert teaches:

The system as defined in claim 4 wherein the data structure is a disjoint graph with the non-overlapping ranges (a globally unique IP address shown in Herbert's figure 3) representing elementary intervals (see Herbert's table 1 representing a class C interval) and the overlapping ranges are disjoint intervals. (see Herbert's table 3 showing disjoint intervals for class A, B, and C).

Claim 6 is rejected under 35 U.S.C. § 102(b) as being anticipated by Caldwell, M., "HP TopTools 5.6 User Guide", Hewlett-Packard Company, May 29, 2002, pp.9-10,81 (hereinafter Caldwell).

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For claim 6, Caldwell teaches:

6. A tree-like data structure (see p. 81, subnet map on screen shot shown) stored on a computer readable medium (see computer readable database e.g. MEDS.mdb on p. 10) is for use in carrying out range specified rule evaluations (see p.81, 7th paragraph, "Locate" feature to find a device within a map on p. 81), the data structure having a rule specified rule set where each rule in the rule set has an equal number of fields (see p. 9, system performance advisor, threshold alerts for CPU, memory, disk I/O, and storage utilization) and each field specifies a range having an upper and lower bound (see p. 81, subnet boundaries inherently have upper and lower bounds) there being the same number of layers in the structure as there are fields in each rule set, the tree-like data structure having a first layer made up of a set of non-overlapping ranges (see unique addresses); and one or more additional layers each made up of sets of non-overlapping ranges

and sets of overlapping ranges (see p.9, private address reused on private subnet); wherein range specified rule evaluations are carried out by one pass (see p.9, discovery services run in one or more processes) through the data structure (without reciting the TopTools implementation, examiner asserts that it is inherently possible to scan the network in a single pass).

Claims 8, 10, 11 and 18 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lakshman et al., U.S. Pat. No. 6,341,130 (hereinafter Lakshman).

For claim 8 and 11, Lakshman teaches.

A method / system of creating an augmented binary tree structure from a range specified rule set, each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals, the method / system comprising:

projecting end points of each interval of the set of intervals onto a line, the end points dividing the line into non-overlapping elementary intervals (See e.g. Lakshman column 4 lines 31-33, 'segments of a filter rule having one or more field ranges of destination addresses projected as horizontal intervals' and figure 4); and

forming the tree structure such that each node of the tree contains a single elementary interval (see e.g. Lakshman Abstract, 'each entry associated with a particular filter-rule'), an indication of original intervals associated with the elementary interval (see e.g. Lakshman Abstract, 'the highest priority filter-rule overlapping each non-overlapping interval is associated with that interval'), and pointers to any adjacent nodes in the tree (by definition, tree nodes have pointers to their adjacent, a.k.a. child, nodes).

For claim 10, Lakshman teaches:

The method as defined in claim 8 wherein the augmented binary tree structure is an elementary interval tree for use in packet classification of computer based communication systems (see e.g. Lakshman Abstract, 'A packet filter for a router').

For claim 18, Lakshman teaches:

An augmented binary search tree structure created in accordance with the method of claim 8 stored on a computer readable medium for classifying packets (see e.g. Lakshman claim 1, 'a storage medium').

Claim 9 is rejected under 35 U.S.C. § 102(b) as being inherent.

For claim 9:

The method as defined in claim 8 wherein the augmented binary tree structure is used for stabbing queries.

Claim 9 is rejected under 35 U.S.C. § 102(b) as being inherent. Claim 9 depends on claim 8, rejected by Lakshman for the reasons above. Claim 9 only adds the limitation that the augmented binary tree structure is used for stabbing queries.
Binary trees inherently support stabbing queries. The applicant's definition of a stabbing query in paragraph [0010] is an algorithm capable of traversing a tree-like data structure. No change would have to be made to the data structures disclosed in claim 8 and Lakshman et al. in order for them to support a stabbing query.

The limitation of claim 9 does not have patentable weight.

The following is a quotation of 35 U.S.C. § 102(e) which forms the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this

subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 8, 9, 11, 13-17 and 19 are rejected under 35 U.S.C. § 102(e) as being anticipated by Henderson et al., US PG Pub. No. 2004/0133590 (hereinafter Henderson).

For claim 8 and 11, Henderson teaches:

A method / system for creating an augmented binary tree structure (see e.g. figure 1b) from a range specified rule set (see [0170]), each rule in the rule set having an equal number of fields (see item 435 in figure 4a) and each field specifying a range having an upper (see UB in box 414 in figure 4a) and lower (see LB in box 414 in figure 4a) bound forming a set of intervals (see e.g. [0050] and items 414, 418, 422, and 426), the method / system comprising:

means for projecting end points (see e.g. end points of items 150, 160, 120, 122, 124 and 126 in figure 1d) of each interval of the set of intervals onto a line (see e.g. item 110 in figure 1d), the end points dividing the line into non-overlapping elementary intervals (see figure 1d and 2 and [0058]); and

means for forming the tree structure such that each node of the tree contains a single elementary (non-overlapping) interval(see e.g. [0066] and step 210 of figure 2), an indication of original intervals associated with the elementary interval (see figure 1d), and pointers to any adjacent nodes in the tree(see figure 1b and [0062] and step 355).

Claim 9 is rejected under 35 U.S.C. § 102(e) as applied to claim 8 as being anticipated by Henderson et al., US PG Pub. No. 2004/0133590 (hereinafter Henderson).

For claim 9, Henderson teaches:

The method defined in claim 8 wherein the augmented binary tree (see [0008] "use of binary tries"; a trie is a degree {n-ary} tree which by definition is an augmentation to a tree) is used for stabbing queries (see [0077] where the first, second, and third best match are exhaustively found until a null ADL pointer is returned so we see all applicable matches result—Henderson's

example does not explicitly recite applicant's phrase but it inherently meets applicant's own definition of the phrase "stabbing query is the type of query where a point data is queried against a set of intervals to determine which of those intervals contains the point." as provided in applicant's [0010]).

For claim 13, Henderson teaches:

The system of claim 11 wherein the augmented binary tree structure is an elementary (non-overlapping) interval tree (see e.g. [0050] and [0058]) for use in packet classification of computer-based communications systems (see e.g. [0171] and [0073]).

For claims 14 and 16:

Henderson et al. teaches a method/system of creating disjoint interval tree from a range specified rule set each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals. ([0050]); combining overlapping intervals of the set of intervals to form larger intervals that are disjoint to each other ([0089]-[0092]); evaluating the overlapping intervals to find the maximum disjoint intervals for the set of intervals. ([0102])

For claim 15 and 17, Henderson teaches:

A method / system for use in packet classification in computer based communication systems (see e.g. [0073] and [0170]).

Claims 15 and 17 do not have patentable weight.

For claim 19:

Henderson et al. teaches a disjoint interval tree created in accordance with the method of claim 14 stored on a computer readable medium for classifying packets (Paragraph 0176)

Claim Rejections - 35 U.S.C. § 103

The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 4, 5, 6 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable by Henderson et al. US PG Pub 2004/0133590A1 (hereinafter Henderson) further in view of Donald Knuth's Fundamental Algorithms, Vol. 1, 2nd edition, Addison-Wesley, 1973, p. 316-317 (hereinafter Knuth).

For claim 1, the Henderson teaches:

A method (see figure 2) of creating a tree-like data structure (see figure 1b, item 100) for use in carrying out range specified (see figure 1c) rule evaluations, the data structure having a rule specified rule set where each rule (see abstract) in the rule set has an equal number of fields and each field specifies a range (see [0014] "IP address range to distinguish the packets") having an upper (see UB in item 542 in figure5a) and lower bound (see LB in figure 5a in item 522), there being the same number of layers in the structure as there are fields in each rule set (See figure 1b, item 104, "RDV-1" and item 112, "RDV-2") , the method comprising:

creating a first layer of the structure made up of a set of non-overlapping ranges; (see figure 2, step 200) and

creating one or more additional layers each made up of sets of non-overlapping ranges (see figure 2, step 200) and sets of overlapping ranges; (see figure 2, step 210) .

Although Henderson teaches sequential ordering as shown in step 200 of figure 2, Henderson lacks explicit teaching of a single pass limitation.

However, Knuth does explicitly teach the limitation of a single pass in the first volume of his Fundamental Algorithms, p. 316, second paragraph, "examining the nodes of the tree systematically so that each node is visited exactly once".

Knuth and Henderson are analogous art because they are from the same field of endeavor of storing data within a tree data structure. They share a relationship in that Knuth's textbook is an undergraduate computer science textbook about tree structures and Henderson represents an industry specific extension of Knuth.

At the time of the invention it would have been obvious to a person of ordinary skill in the art of designing a data structure to combine the specific tree of Henderson with the explicit single pass teaching of Knuth using the suggestion provided by Cormen also in the endeavor of using data structures.

The suggestion to combine can be found in the applicant's reference of Cormen p. 308-309, "...augmenting a basic data structure to support additional functionality occurs quite frequently in algorithm design. It will be used to again in the next section to design a data structure that supports operations on intervals." Citations also exist in Cormen that direct the reader to Knuth's book. One art specific motivation to combine is the desire to use the simplest tree traversal algorithm.

For claim 4, the Henderson teaches:

A system (figure 2) of creating a tree-like data structure (see figure 1b , item 100) for use in carrying out range specified (see figure 1c) rule evaluations, the data structure having a rule specified rule set where each rule (see abstract) in the rule set has an equal number of fields and each field specifies a range (see [0014] "IP address range to distinguish the packets") having an upper (see UB in item 542 in figure5a) and lower bound (see LB in figure 5a in item 522), there being the same number of layers in the structure as there are fields in each rule set (See figure 1b, item 104, "RDV-1" and item 112, "RDV-2") , the method comprising:

creating a first layer of the structure made up of a set of non-overlapping ranges; (see figure 2, step 200) and

creating one or more additional layers each made up of sets of non-overlapping ranges (see figure 2, step 200) and sets of overlapping ranges; (see figure 2, step 210) .

Although Henderson teaches sequential ordering as shown in step 200 of figure 2, Henderson does not explicitly teach the limitation of a single pass.

However, Knuth does explicitly teach the limitation of a single pass in the first volume of his Fundamental Algorithms, p.316, 2nd paragraph, "examining the nodes of the tree systematically so that each node is visited exactly once".

Knuth and Henderson are analogous art because they are from the same field of endeavor of storing data within a tree data structure. They share a relationship in that Knuth's textbook is an undergraduate computer science textbook about tree structures and Henderson represents industry specific extension of Knuth.

At the time of the invention it would have been obvious to a person of ordinary skill in the art of designing a data structure to combine the specific tree of Henderson with the explicit single pass teaching of Knuth using the suggestion provided by Cormen also in the endeavor of using data structures.

The suggestion to combine can be found in the applicant's reference of Cormen p. 308-309, "...augmenting a basic data structure to support additional functionality occurs quite frequently in algorithm design. It will be used to again in the next section to design a data structure that supports operations on intervals." Citations also exist in Cormen that direct the reader to Knuth's book. One art specific motivation to combine is the desire to use the simplest tree traversal algorithm.

For claim 5, Henderson further teaches:

The system as defined in claim 4 wherein the data structure is a disjoint graph (figure 11d) with the non-overlapping ranges (see items 150 and 160 in figure 1d) and the overlapping ranges (see step 215 in figure 2) are disjoint intervals. (see items 150 and 160 in figure 1d).

For claim 6, Henderson teaches:

A tree-like data structure (see figure 1b in item 100) stored on a computer readable medium (see machine readable medium in [0177]) for use in carrying out range specified rule evaluations, (see figure 1c) , the data structure having a rule specified rule set where each rule (see abstract) in the rule has an equal number of fields and each field specifies a range(see paragraph 14 "IP address range to distinguish the packets") having an upper (see UB in item 542 in figure 5a) and lower bound (see LB in figure 5a in item 522), there being the same number of layers in the structure as there are fields in each rule set (See figure 1b, item 104, "RDV-1" and item 112, "RDV-2"), the tree-like data structure having a first layer made up of a set of non-overlapping ranges; (see figure 2, step 200) and sets of overlapping ranges; (see figure 2, step 210)

Although Henderson teaches sequential ordering as shown in step 200 of figure 2, Henderson does not explicitly teach the limitation of a single pass.

However, Knuth does explicitly teach the limitation of a single pass in the first volume of his Fundamental Algorithms, p.316, second paragraph, "examining the nodes of the tree systematically so that each node is visited exactly once".

Knuth and Henderson are analogous art because they are from the same field of endeavor of storing data within a tree data structure. They share a relationship in that Knuth's textbook is an undergraduate computer science textbook about tree structures and Henderson represents industry specific extension of Knuth.

At the time of the invention it would have been obvious to a person of ordinary skill in the art of designing a data structure to combine the specific tree of Henderson with the explicit single pass teaching of Knuth using the suggestion provided by Cormen also in the endeavor of using data structures.

The suggestion to combine can be found in the applicant's reference of Cormen p. 308-309, "...augmenting a basic data structure to support additional functionality occurs quite frequently in algorithm design. It will be used to again in the next section to design a data structure that supports operations on intervals." Citations also exist in Cormen that direct the reader to Knuth's book. One art specific motivation is the desire to use the simplest tree traversal algorithm.

Claim 7 is rejected under 35 U.S.C. § 103(a) as applied to claim 6 as being unpatentable by further reading of Henderson et al. US PG Pub 2004/0133590A1 in view of Knuth.

For claim 7, Henderson further teaches:

The tree-like data structure as defined in claim 6 wherein the data structure is a disjoint graph (see figure 11d) with the non-overlapping ranges r(see items 150 and 160 in figure 1d) representing elementary intervals (see items 150 and 160 in figure 1d) and the overlapping

ranges (see step 215 in figure 2) are disjoint intervals (see items 150 and 160 in figure 1d) for performing evaluations (see [0048] "rule evaluation") relating to packet classification in communications systems. (see [0171], "The system of figure 16b may be used in a routing application or a packet classification application, or both. For example, the system may be a part of a switch or a router.")

Claim 10 is rejected under 35 U.S.C. § 103(a) as applied to claim 8 as being unpatentable by further reading of Henderson et al. US PG Pub. 2004/0133590A1(hereinafter Henderson) in further view of Gallo US Pat. No. 6,700,883 (hereinafter Gallo).

For claim 10, Henderson teaches:

The method as defined in claim 8 wherein the augmented binary tree structure (Henderson) is used is an elementary interval (see figure 1d) tree for use in packet classification (Henderson, paragraph 171, a packet classification application) of computer-based (Henderson differs from the claimed invention with no explicit teaching about a "computer") communications (see item 1705 in figure 17 of Henderson) systems.

Henderson lacks explicit mention of the term computer, but mentions parts of a computer in figure 17 such as a processor (see item 1700), network interface (see item 1705), and software (see items 1722 and 1715).

Gallo recites the missing term of a computer in the context of a communications system (see paragraphs 2-3, "computer networks").

The references of Henderson and Gallo are analogous art because they are both trying to improve packet classification.

At the time of the invention, it would have been obvious for a person of ordinary skill in the art to combine Henderson to use a computer in the transport layer discussed in Gallo to produce the limitation of a computer based communications system.

The suggestion to combine references comes from paragraph 2 of Gallo, "The problem of the design of computer networks is partitioned into smaller subtasks, by dividing the problem into layers. The OSI (Open Systems Interconnection) reference model defines seven layers. This invention is primarily concerned with the protocols of Layer 3, the network layer, and Layer 4, the transport layer. One motivation is the desire for greater compatibility as it enables different computer vendors to reuse an underlying computer independent network layer.

Claim 12 is being rejected under 35 U.S.C. § 103(a) as being unpatentable over Henderson et al. US PG Pub. No. 2004/0133590 (hereinafter Henderson) as applied to claim 11 above, and further in view of Afek et al. U.S. Pat. No. 6,633,860 (hereinafter Afek).

Henderson teaches the limitations of claim 11 for the reasons above.

Henderson differs from the claimed invention in that its reference to an augmented binary tree does not explicitly recite the term "stabbing queries".

Afek teaches an augmented binary tree (multi- dimensional segment tree) used for stabbing queries (see column 5, lines 4-10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an augmented binary tree for stabbing queries.

The suggestion to combine Henderson and Afek is found in Afek which states that using such a data structure represents an efficient and effective way to facilitate stabbing query (also known in the art as comprehensive search or exhaustive search). The art specific motivation stems from a desire to make firewalls fully comply with security policies having more than one rule.

Conclusion

The prior art of record, listed on form PTO-892, in addition to what examiner relied upon is considered pertinent to applicant's disclosure.

The following patents and pre-grant publications seem pertinent sampling of a reflection of the general state of the art when solving the same practical problem as applicant:

US PG Pub No. 2004/0258043A1, "Packet Classification"

US PG Pub No. 2004/0093414A1, "System for Prevention of Undesirable Internet Content"

US PG Pub No. 2004/0191605A1, "Packet Classification"

US Patent 6,061,687, "Linked Lists of Transfer Descriptors Scheduled at Intervals", see Fig. 5

US PG Pub No. 2003/0115328A1, "Firewall for Filtering Tunneled Data Packets"

US PG Pub No. 2003/0014519A1, "System and Method for Providing Discriminated Content to Network Users"

US Patent 6,763,467, "Network Traffic Intercepting Method and System"

US PG Pub No. 2005/0015453A1, "Method and System for Internet Censorship"

EP 1 128 608A2, "Method and means for classifying data packets"

The following non-patent literature seem pertinent as multi-solution review articles that summarize what each author believed was available around the time of publication:

Bentley, J. L., "Data Structures for Range Searching", ACM Computing Surveys, Vol. 11, No. 4, December 1979, pp. 397-409.

Gupta, P. et. al, "Algorithms for Packet Classification", IEEE Network, March-April 2001, p. 24-32.

Knuth, D. E., "The Art of Computer Programming, Vol. 4, Fascicle 4: Generating All Trees-History of Combinatorial Generation", February 2006. This was considered not to be prior art but rather to summarize the author's view of the current state of the art around the time of examination.

The following non-patent literature and the corresponding program seem relevant in regards to claims 1, 4, and 6. It was not applied because the examiner of record did not find this prior art until after completing the first action on the merits:

Hewlett-Packard Company, "A Guide to Scalability and Distribution for HP OpenView Network Node Manager", 1st Ed, 1998, pp. 32, 36, 41, and 48.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph D. Wong whose telephone number is 571-270-1015. The examiner can normally be reached on Mon.-Thur. 7:30AM - 5PM and every other Fri. 7:30-4PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David V. Bruce can be reached on 571-272-2487. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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